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		Engineer Preparation of Positions of	Missile Units
		Engineer preparation of the terra for missile units is carried out with ensuring convenience of delivery of fispeed of maneuver, concealed disposit protection of the personnel and equipmeans of destruction.	the object of ire and control,
		The degree and nature of the engine depends on the time and materials avaitof the terrain, the time of year, and reinforcement of the missile units by subunits and equipment for carrying or work mechanically.	ilable, the nature also on the combat engineer
		Engineer preparation of the terrain as a rule, in a definite sequence. The work is laid down by the commander in situation, manpower available, time, and materials. In all cases during the siting areas (positsionnyy rayon), should be given to the carrying out of it would be impossible to prepare for launch the missiles, and as second priecise.	se sequence of the accordance with the sechanized equipment, se preparation of first priority work without which launching and to
		The basic extent of the engineer was preparation of concentration areas, apespecially the siting areas.	ork includes the proach routes, and
		In this article are given the basi (polosheniye) concerning the engineer concentration areas of missile units, given for engineer preparation of siti a brief examination of the basic featu preparation of the terrain for these u and winter conditions.	preparation in the recommendations are mg areas, as well as
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Engineer Preparation of the Terrain in the Concentration Areas
The basic tasks of engineer preparation of the terrain in the concentration areas of missile units are:
-camouflage of combat and transport equipment using materials at hand and organic camouflage material;
-the preparation of cross-country routes in the concentration areas and for moving out equipment on to the main route;
-construction of covered positions for personnel;
-preparation of command posts;
-construction of cover of the dugout type for special equipment (in the absence from the terrain of natural cover and camouflage);
-preparation of positions for self-defense;
-preparation of water supply points.
As the stay of the troops in the concentration area is of short duration, the volume of engineer preparation work done must be the minimum necessary.
When selecting the concentration areas, in order to reduce the volume of engineer work, it is necessary to make maximum use of the camouflage and protective characteristics of the terrain, of the existing approach routes and roads, and also take into account the possibility of organizing protection and self-defense with a minimum expenditure of forces and weapons.
To ensure protection against enemy means of destruction, the subunits in the concentration area must be dispersed over the terrain (by batteries). The distance between the batteries must be not less than 1 to 2 kilometers. 50x1-HUM
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On occupation of the concentration area, as first priority, a concealed disposition of combat and transport equipment is carried out with the maximum use of natural cover and camouflage, and roads also are prepared for a quick exit of the equipment to the main route to proceed to the launching area. After this, structures the personnel of the subunits is prepared.

The approximate extent of work of engineer preparation of the terrain in the concentration area of a unit (battalion) and the required manpower and equipment for their fulfilment are shown in Table 1.

Table 1

Designation of work	Unit of Measure	Quantit	Ke	Requirements		
Amoutlana		- Ammeri	Man/ Days	Bulldozer Machine/ Hours		
Camouflage of combat and transport equipment	-	-	100			
reparation of cross- ountry routes to exit in the main route	ka	10				
onstruction of slit renches for 30 to Dercent of the ersonnel		10	18	10		
ection of blindages on prefabricated ements at the command	item	30	45	-		
Observation of Anna	•	3	36	_		
- delense	,	30	•	-		
tal for a concentra- on area (in round				7		
rures)	i	I	20C	10		

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	Table 1 shows that the work of engineer preparation of the terrain in the concentration area of a battalion can be completed in one twenty-four hour period employing 50 percent of the personnel of the battalion and one bulldozer.
	Taking into account that the battalion will move to the concentration area, carrying out the march as a rule at night, it is necessary to plan so that the camouflage work for the concealment of combat and transport equipment should be completed before daybreak.
	Engineer Preparation of Terrain in Siting Areas
	In the siting areas of missile units, primary and alternative launching sites, a technical position, site of the meteorological post, command post, disposition area of transport and fuelling batteries (batarsya) and the disposition area of servicing subunits are prepared. (Shetch 5).
	Diagrams of engineer preparation of some elements of a battery in battle formation are shown in Sketches 6 to 10.
	The main tasks of engineer work in the launching areas are:
	-the construction of launching pads (puskovaya ploshchadka) at the primary and alternate launch sites for those missile units whose launch batteries do not possess special starting assemblies (spetsialnyy startovoy agregat);
	-the construction of open structures of the dugout type that ensure covered displacement of the combat and transport equipment at the positions and in the disposition areas of the subunits of the battalions;
	-the construction of structures as cover for personnel (slit-trenches, blindages, shelters) at the positions, at the command and medical points, as well as in 50x1-HUM
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	disposition areas of the subunits of the	
	-the construction of open structures protection and self-defense of the post of disposition of the subunits of the	itions and areas
	-camouflage measures to conceal the disposition areas and areas of maneuve	positions, the r;
	-the preparation of the maneuver ro of deployment of battle formations of	utes in the area the missile artillery.
	To ensure the launching of the mis launching sites, prefabricated pads (sploshchadka), which can be made from ror wood, are used under the launcher (borno-razbornaya einforced concrete
	The platforms are placed on a natural base and are fastened to the ground wiscrewed-in anchorposts (anker). On his it is impossible to use such anchorposis done by the use of logs and chains.	th the help of ard ground, where its, the anchoring
	It takes 2.5 to 3.0 hours to erect pad, calculated on the use of 8 men (vehicle available).	t a prefabricated with a K-32 crane
	If the launch batteries possess the which permit them to mount in a vertical launch the missile, the construction cunnecessary.	cal position and
•	To conceal the special equipment transport at the positions and in the dugouts (kotlovan) are dug with one o (apparel) (cul-de-sac or drivethrough prokhodnyy). The size of the dugout by the overall dimensions of the equi	disposition areas, r two approach rumps - tupilovyy ili shelters is governed
	The excavation of shelters for sp motor vehicle transport is carried ou attached mechanical earth-moving equi excavators), as well as manually.	t with organic and
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During the excavation of dugouts by bulldozers, squads of 2 or 3 men should be detailed to each bulldozer in order to collapse the earth from the sides of the excavation and to give the required steepness. The same squads should carry out the cleaning up of the berms (berma) and the layout of the parapets (brustver).

When excavators are used for digging dugouts the reverse scoop (obratuaya lopata) is employed. After the excavator has excavated the dugout, manual clearing up of the slopes; the bottom, and the approach ramps of the shelter is required.

For manual excavation of the dugout, the size of the squad depends on the size and type of soil, time available for excavation, and the frontage of the work.

The simplest form of cover for personnel is slit trenches (shchel). These slit trenches are dug to a depth of 1½ meters and are 5 to 6 meters long. If time and materials are available, the slit trenches are built with a roof.

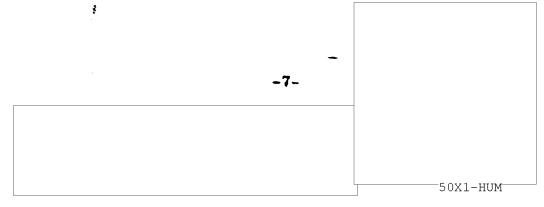
In order to increase the degree of cover for personnel from destruction by enemy atomic weapons in the siting areas, light shelters and blindages (blindazh) are constructed.

For the construction of shelters and blindages the following can be used:

-construction from locally available materials (mainly timber) built by the forces and equipment of the missile artillery units themselves;

-construction from industrial corrugated steel sheets (for structures "EVS-U", elements "FVS") and plywood (for structures "EFU") as supplied to the Soviet Army);

-construction from prefabricated reinforced concrete components made at field concrete plants or at the reinforced concrete plants attached to the army (front).



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	Besides the above-mentioned types of construction, for the building of shelters and blindages in treeless, mountainous, and sandy desert areas, paper sand bags can be used. The blindages are constructed with a capacity of 6 to 8 persons. The interior, as a rule, consists of bunks built in two tiers and made from materials available locally.
	Unlike the blindages, the shelters are constructed with a capacity of 20 to 25 persons and they are equipped for collective antichemical defense. In these shelters, filtered ventilation is installed using field sets FVKP-Ml, hermetically sealed partitions and doors, and in wintertime, OPP stoves. For the accommodation of personnel in the shelters, two-tiered bunks are made from materials available locally (at command posts - tables for work).
	The total volume of work, the expenditure of manpower, equipment, and materials for the engineer preparation of the siting area of a battalion are shown in Table 2.
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Table 2

	Manpower, equipment, materials, and work					
Elements of a battalion in battle formation	Volume of earth works in cubic meters (M3)	Volume of timber in M ³	No of shelters	Mumber of blindages	Man-days	Machine- hours
Primary launch sites (3)	1600 2300	23.1 23.1	<u>3</u> 3	-	90 81	30 48
Alternate launch sites (3)	1200	-	-	-	<u>-</u> 33	- 22
Technical position	3000 4200	18.5 53.9	7	5	96 161	52 94
Meterological post	610 140	7.7	1-	-	<u>86</u>	12 12
Command post	390 430	18.4 22.8	2 2	2	44 65	8 9
Disposition area of the transport and fuelling batteries	1200 2000	3.7 23.1	3	1	30 54 54	33 45
Disposition area of servicing subunits	30 1550	38.7	Ī	Ī	5 105	- 33
Total for a battalion (in round figures)	6800 11700	70 180	6 19	6	270 530	140 250

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Notes:		
	1.	The numerator shows work to be carried out as first priority and the denominator represents work to be carried out as second priority.
	2.	The sequence of work laid down in the table envisages as first priority the following:-
		 construction of shelters (ukrytiye) for vehicles and assemblies which remain at the launching sites during firing, and shelters for the missiles at the positions and in the disposition areas;
		 partial preparation of the technical position and meteorological post;
		- the construction of part of the shelters for the personnel at the command post.
		All other work is carried out as second priority.
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For guarding and defending positions and disposition areas of battalion subunits against attack by the ground enemy, diversionist groups, and airborne landings, positions for self-defense are constructed. Each position is provided with trenches for fire from a standing position and are connected by communication trenches. Available local features (ditches, pits, embankments, separate buildings, etc.) are adapted for defense.

In order to conceal the composition and the direction of troop movement, to conceal their disposition areas, and to mislead the enemy as to the true intentions of our troops, it is necessary to carry out on a unified plan a number of measures of troop camouflage and operational camouflage (operativnaya maskirovka).

Troop camouflage measures are carried out continuously in all types of combat directly by the troops themselves, and represent part of the general plan of the engineer camouflage measures of the front.

Operational camouflage measures are a component and integral part of the decision to carry out an operation and are implemented by the engineer units according to the operational camouflage plan of the front.

The variety of methods of camouflage and its continuity during the operation form the main principles of operational camouflage, if they are not observed it is impossible to ensure effective surprise and to bring about enemy action in a direction advantageous to us. Achievement of surprise requires thoroughly worked out camouflage measures which actively and continuously mislead the enemy.

To such measures, first of all, should be added the creation of dummy (lozhnyy) disposition areas of missile elements in combat formation, feint actions (demonstrativnoye deystviye), disinformation, and all kinds of engineer camouflage work.

The camouflage measures for creating dummy disposition areas of missile artillery, which are carried out on an extensive scale by the engineer units of the front, not only mislead the enemy but considerably lower the effectiveness of the use of his weapons of destruction, and compel him to deliver atomic strikes on dummy objectives.

Under modern conditions, with the thorough concealment of the actual disposition areas of the troops, it is necessary to display the dummy areas at a sufficient distance away from the actual areas so as to ensure the safety of the latter if the enemy carries cut an atomic strike.

In this respect, the plan for operational camouflage of the front must define the sequence, place, and time limits for carrying out the engineer camouflage measures, based on the grouping of the troops and the time limits for carrying out the operation as a whole.

Correctly planned camouflage measures to conceal the true objectives and to display to the enemy the dummy objectives can assist in conserving our material and morale forces and also decrease losses from the enemy use of weapons of mass destruction.

In the dummy areas, the billeting and activity of troops are simulated.

The simulation of missile equipment in the dummy areas is achieved by the setting up (ustanovka) of high-quality prefabricated dummies (sborno-razbornyy maket), of the most typical types of equipment (launching assembly with missile, cross-country carriers - gruntovaya telezhka, saddle crane - sedelnyy kran, and others). The dummies must be industrially produced and be delivered by the front in a centralized manner. During the simulation of occupation of dummy areas by subunits of the missile artillery, means of transport are assigned (unemployed cross-country carriers or ordinary trucks with semi-trailers

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equipped with camouflage frameworks) which carry out traffic movement in the dummy areas and on the roads leading to them.

The quantity of dummy equipment and the dummy engineer structures for it must be up to 50 percent of the organic battle equipment of the subunits represented. For dummy launching assemblies with missiles the norms must be not less than 100 percent.

In the areas displaying dummy launching sites, checking-out points, fuelling, and other elements of combat formation, reliable shelters will have to be built for the personnel of the subunits detailed to carry out the simulation.

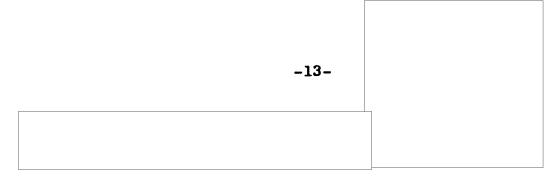
Artificial scarring (raspyatneniye) of the ground in conjunction with the dummy shelters adds to the completeness of the engineer preparation of dummy disposition areas of missile artillery.

This scarring of the terrain is carried out by means of removing the topsoil with a bulldozer, grader, or other excavating vehicles. The patches that are formed must correspond with the patches that are created as a result of moving the spoil (otsypka) and leveling it out after it is taken from the dugouts during the construction of real shelters. The size of these patches should be 600 to 700 m² for normal equipment and 800 to 1,000 m² for equipment of large dimensions.

During the display of dummy objectives and simulated actions of missile equipment, one must always keep in mind the possibility of enemy radar surveillance. By an intelligence use of suitable means during the display of dummy objectives, the enemy can be misled.

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For this it is most advisable to use corner reflectors (ugolkovaya otrazhatel). Calculations show that when simulating a launching site it is necessary to use approximately up to 30 of these reflectors of various types (KT4-100 - 3 reflectors, K1-100 - 12 reflectors, K8-600 - 15 reflectors).



The camouflage of missile units. The object of camouflaging missile units is to ensure the concealment of their actions and disposition areas from all modern means of optical, radar, and aerial reconnaissance of the enemy.

The engineer preparation of the terrain must begin with the camouflage measures and end with them. Here it should be taken into consideration that ill-timed and tardy camouflage is not only useless, but even harmful.

The main camouflage tasks for the siting areas are:

-the concealment of the elements of units in combat formation at the siting areas;

-the concealment of combat and transport equipment and engineer structures;

-the concealment of the movement of transport and fuelling batteries from the disposition areas to the launching sites and back again.

The concealment of the elements of units in battle formation in the siting areas is achieved by: making use of natural camouflage (concealment features and configuration of the terrain, conditions of limited visibility); by combining siting areas with defense zones and concentration areas, previously equipped but not occupied by combined-arms units (large units), and in certain cases with dummy areas, identified (as dummy ones) by the enemy, by constructing alternate positions.

As means of natural camouflage, one can make use of forests, groves, gardens, inhabited localities, and unevenness of the terrain (gullies, hills, and various folds of the ground).

Approximate requirements for natural camouflage for concealed and dispersed disposition of elements of a combat formation of a battalion in a siting area are shown in Table 3.

Table 3

Designation of elements of a bettalion in battle order	Number of units of calculation*	Forest area in hectares	No. of house- holds in a rural inhab- ited locality	The length of gullies in kilometers
Launching site (one)	16	1.2	8	0.3
Technical position	100	8	50	2
Disposition area of the transport & fueling batteries	150	12	75	2.5
Battalion Command Post	9	0.7	5	0.2
Meteorological Post	8	o.6	4	0.15
Total for a battalion (in round numbers)		25	140	6

*A unit of calculation (raschetnayayedinitsa) for equipment is considered to be an artillery prime mover, troop transport, or special vehicle. Equipment of large dimensions (cross-country carrier or ground carriage with a prime mover, and others) is correspondingly equal to three to four units of calculation.

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With the absence or shortage of natural camouflage and the necessity for the disposition of troops in open ground, the camouflage of missile units in combat formation becomes much more difficult and assumes paramount importance. The most acceptable decision in such a case is the movement (razmeshcheniye) of the elements of the units in combat formation to prepared positions not occupied by combined-arms units or large units (Sketch 11). With such a disposition it is advisable to combine the shelters for the equipment with the trenches and group shelters that have been dug but not occupied by tanks and artillery, and they should be included in the system of trenches and communication trenches.

In a terrain previously prepared, but not occupied by the troops, the shelters and the whole system of trenches and communication trenches built by them represent not only defensive works but also camouflage which permits the concealment of subunits with their equipment from enemy optical, radar, ground, and aerial surveillance.

The concealment of the engineer structures and combat equipment deployed in shelters and outside them is achieved through the use of technical methods of camouflage (the employment of artificial camouflage, laying smoke-screens, camouflage paint, etc.).

For technical methods of camouflage the following are used:

-organic means (camouflage sets - komplekt masok);

-expendable resources and materials (camouflage coverings, camouflage paper, smoke means and others);

-locally available materials are widely used by the troops in all situations (poles, brushwood, etc.).

Sketches 12 to 19 show the most typical technical methods of camouflaging missiles, special equipment, and shelters with special equipment at the sites and in the disposition areas.

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The concealment of the shift of missile units can be attained by organizing the move under conditions of limited visibility (night, rain, fog). The transport routes must be chosen in concealed and uninhabited areas.

To lessen the conspicuousness of the characteristic exterior shape of missiles moving on the cross-country carriers, tank trucks, and other combat equipment, it is essential to use decorative camouflage frames (karkas) covered with canvas or with camouflage netting MPT-4; at the same time the covering must have a coloring that breaks up the outline. It is necessary to erect on the frames half-dummies (polumaket) of normal equipment. For example, a cross-country carrier with a missile on a trailer drawn by a prime mover can be camouflaged as a motor convoy (avtopoyezd) (Sketch 20) or as a load of long lumber (Sketch 21).

In order to use this camouflage method more successfully, it is essential, in each individual case, to determine the most suitable object for disguising this or that vehicle, keeping to the principle of varying the camouflage.

The antiradar camouflage of the missile units in combat formation at their siting areas must be directed against the detection of the latter, mainly by the airborne radar stations of the enemy. This is attained by:

-making use of the camouflage properties of the terrain, i.e., the disposition of objectives in the dead zone (v zone poley nevidimosti) created by the unevenness of the ground, by local features, and other natural camouflage;

-the disposition of combat equipment in trenches and shelters:

-the setting up of artificial antiradar camouflage material (camouflage screens and interference camouflage - mask-ekran i mask-pomekh);

-the use of special radiotechnical equipment for creating jamming of the enemy radar stations.

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The requirement of personnel and equipment for carrying out the camouflage measures in the siting areas depends on the condition of the situation and terrain and can fluctuate widely.

Preparation of roads and cross-country routes is one of the most important conditions for ensuring the uninterrupted combat activity of missile units.

The presence in these units of heavy equipment (materialnaya chast) of large dimensions levies greater demands on roads and cross-country routes.

The main technical demands levied on roads and cross-country routes are shown in Table 4.

Table 4

Basic indices	Quantity
Width of the roadway (minimum) in meters:	
- for two-way traffic	7.0
- for one-way traffic	3.5
Minimum turning radius in meters	15.0
Longitudinal slope of the roadway (maximum) in degrees	10-15°
Camber in degrees:	
- of roadway	10-150
- on bends (maximum)	8 ⁰
Load capacity of bridges and various road structures in tons	40.0
Bridge clearance (minimum) in meters	4.0
Minimum permissible pressure on the road- bed, in kg/cm ²	0.8



The total extent of roads in the siting area of a missile artillery battalien consists of 30 to 40 kilometers (from the technical position to each of the launch sites the distance is from 5 to 8 kilometers, inside the technical position up to 8 kilometers, and from the disposition area of the transport and fuelling batteries to the technical position, 4 to 6 kilometers).

The engineer preparation of movement routes includes the reconnaissance of the existing roads and paths of cross-country routes, restoration and repair of existing roads, and the construction of cross-country routes.

In the preparation of the routes it is essential to make maximum use of the existing road network. The building of new roads coming to a dead end at the sites is inadmissible from the point of view of camouflage of the positions. The necessary volume of road work in the launching areas is determined by the availability of existing roads, their number and condition, the possibilities of moving cross-country without roads, as well as the capabilities of the missile artillery units for the preparation of roads.

The presence of existing roads, their condition, as well as the possibilities of moving cross-country without roads, depend mainly on the theater of operations and on the destruction existing there.

The capabilities of a battalion in the preparation of routes are determined on the basis of the personnel and equipment which the battery can employ for engineer preparation of movement routes. Approximate increased work norms for the construction of movement routes are shown in Table 5.

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	Time norms	Required personne
Designation of work	in hours	and equipment
Laying of 1 km of cross- country route for one-way traffic		
 on average broken (sredneperesechennyy) terrain 	0.7 to 1.2	Platoon, crane vehicle, bulldozer (BAT), mine detectors
- in a forest area	3 to 5	Platoon, crane vehicle, bulldozer (BAT), mine detectors
- in a mountainous area	1 0 to 15	Company (rota), bull- dozer (buldozer - BAT), explosives - 70 to 100 kg, mine detectors
Restoration and repair of 1 km of existing road for the width of one- way traffic)	1.2 to 2	Bulldozer, motor-grader a section of soldiers, mine detectors

Note: During the laying of cross-country routes and the restoration and repair of roads, it is compulsory to check them for the presence of mines.

With the presence of a combat-engineer platoon, a missile artillery battalion will be able to carry out only minor work with its manpower on the improvement of approach roads leading to the sites.

The engineer preparation of the main routes in the siting areas and particularly of the movement routes during the battle (operation), as a rule is carried out by the engineer units of the army (front) or by the road-engineer subunits attached to the missile units (large units).

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The total volume of work and the expenditure of personnel and equipment for engineer preparation of a battalion siting area are given in Table 6.

Table 6

		volume		Manpo	wer &	equi	pment	requ	ireme	nts
		vation c mete		Man	-days		Mach	lne-ho	ours	
Designation of work	1st Priority	2nd Priority	Total	1st Priority	2nd Priority	Total	1st Priority	2nd Priority	Total	Lumber in m3
Checking the terrain for mines	-	-	•	50	-	50	-	-	-	-
Engineer preparations of the terrain	6800	11700	18500	290	510	800	1,40	250	3 90	235
Camouflage measures	-	-	-	76	50	126	8	3	11	15
Preparation of roads and cross-country routes	-	-	-	100	-	100	20	-	20	10
Preparation of water supply points	-	-	-	-	40 ·-	40	-	-	-	14
Total for siting area (in round figures)	6800	11700	18500	510	560	1070	170	250	420	260

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Note: The checking of the terrain for mines is carried out by the attached combat engineer subunits and does not enter into the total volume of engineer preparation.

	From Table 6, it follows that the most labor-consuming part of the engineer preparation at siting areas is the earth-moving operations (up to 19,000m3 of soil).
	When 60 to 70 percent of the personnel and organic mechanical equipment are employed to carry out the full volume of engineer preparation of the battalion siting area, a considerable amount of time will be required (up to 8 days). This amount of time, however, cannot be allowed in practice. Therefore, in order to reduce the time for the engineer preparation of a siting area, missile units should be supplied with additional earth-moving equipment (bulldozers, excavators), and in cases when roads are in an unsatisfactory condition, with a bulldozer (puteprokladchik) BAT. It is advisable to make use of attachable bulldozer
	By reinforcing the battalion with 4 to 5 bulldozers (or with 4 to 5 sets of attachable bulldozer equipment for the prime movers AT-T and AT-S), the first priority engineer preparation at the siting area can be completed within two 24-hour periods, and the second priority preparation within three 24-hour periods (see Table 2). Besides, all the main earth-moving operations will be completed with the aid of mechanized equipment.
	Special Features of Engineer Preparation in Mountainous Terrain
	The nature of engineer preparation of positions in mountainous terrain is determined by the special features of mountain conditions, of which the principal are: -limited number of roads;
	-difficulties in getting bulky equipment through the existing mountain roads;
	-a sharply broken terrain, which helps in the camou- flaging of the disposition of the missile units, but at the same time makes the choice of combat positions more difficult;
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-the widespread prevalence of stony and rocky soil which requires loosening and blasting operations, making the use of mechanical earth-moving equipment difficult.

The above-mentioned special features hamper engineer preparation in concentration areas and siting areas, the preparation of a road network, and to a great extent increase the expenditure of labor for engineer preparation of the terrain.

To ensure the moving out of units from concentration areas (disposition areas) to siting areas, routes are prepared in good time, one for each battalion. When it is impossible to provide one route for each battalion, a large unit of missile units is allotted 1 or 2 routes, or they are prepared, but when approaching the siting area, 5 to 10 km from it the routes must branch, providing one route per battalion. In order to conceal the places of disposition of the siting areas from enemy aerial reconnaissance, the routes for movement of the battalions to these areas must not be constructed from the same point as the large unit route.

In the siting area one through route and approach routes to the separate elements of the battalion in combat formation are prepared.

In order to reduce the volume of work of preparing the routes and approach routes in mountain conditions, it is essential to make the maximum use of existing roads, preparing them for transit by missile equipment, the cross-country routes should be laid in the sectors of the terrain with the minimum amount of work, and sectors with rocky and other hard ground where mechanical equipment cannot be used should be bypassed if possible.

The routes are prepared by the personnel of the traffic control detachments (otryad obespecheniya dvizheniya - OOD). The composition of these detachments depends on the specific volume of the road and bridge work, which is determined during the engineer reconnaissance of the route, and can include 1 to 2 combat-engineer platoons with motor vehicle transport, a road-layer BAT (or bulldozer), explosives (100 to 200 kg), road signs, and materials for bridge and other road structures.

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In order to increase the traffic capacity of the mountain roads, and to ensure the safe movement of heavy and bulky equipment, it is necessary:

-to construct the roadbed so that it is banked on the side away from the mountain so that it slopes 2 to 2.5 percent toward the mountain;

-to increase the radii of the curves at sharp bends of the roads;

-to erect guardrails (ograzhdeniye) on all steep slopes at the cuter edge (brovka) of the road - wooden or metal rail posts, barriers made from separate rocks, etc.;

-at steep ascents, descents, and bends of the road, to have available stocks of materials (sand, crushed rock) to ensure normal movement in rainy weather and icy periods;

-at the sectors most dangerous for traffic (long grades, precipices, etc.) to install mechanical equipment (prime movers, winches) in order to give assistance to passing equipment;

-to equip the routes with road signs and indicators for day and night traffic:

-to maintain an average speed in mountains of up to 10 to 12 kph in daytime, 4 to 6 kph at night, and $1\frac{1}{2}$ to 2 kph in mountain pass areas.

For the concealment of combat and transport equipment in the concentration areas and siting areas, maximum use should be made of the locally available camouflage capacity and natural cover.

The erection of engineer structures as shelters for personnel, combat and transport equipment in rocky and other ground difficult to work in must be kept to the minimum necessary.

In a mountainous area, the bulldozer equipment for earthmoving operations with prime movers should be used first of all with the AT-T prime mover.

Depending on the nature of the ground, the engineer structures for shelter of personnel and equipment can be of the dugout, half-buried and earthwork type of construction.

The dugout structures (kotlovannyy) are, as a rule, constructed in places where it is possible to excavate with earth-digging machines or manually to a depth of not less than l_2^1 to 2 meters.

The half-buried (poluzaglubennyy) types of structures are made by digging dugouts to a depth of 90 to 100 cm. In this case the structures are made with raised parapets (revetments - obsypka).

The earthwork type (nasypnyy tip) of structure is constructed when the layer of topsoil is shallow (20 to 50 cm) and has a rocky base. In this case the rock is not worked on, but high embanked parapets (revetments) are built of stones, earth-filled fascines, sandbags, etc.

For the construction of dugouts in rocky ground, explosives and compressors with pneumatic tools (pnewmoinstrument) or electric drills (elektroperforator) should be used to the maximum possible extent.

When using explosives in the construction of dugouts, the following approximate expenditure of explosives for one cubic meter of excavated ground will be required;

- -on hard and stony ground 1.5 to 1.9 kg;
- -on rocky ground 2 to 2.6 kg

The dugouts for shelters and blindages are constructed in rocky ground by using a single or several, buried, concentrated charges. For example, the construction of a dugout for a light type of shelter using a single concentrated charge is shown in Sketch 22.

Dugouts for the sheltering of equipment are constructed by using several concentrated charges. The number of charges used and the distances between them depend on the dimensions

50X1-HUM

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50X1-
of the shelter to be constructed, and the size of the charges depends on the type of soil. By placing the charges at a depth of 90 to 110 cm, a hole with a depth of 1 to 1.4 meters is formed.
After the explosion the holes are finished off manually and raised parapets are built. The approach ramps are made by using additional explosive charges, equal to half the normal charge, and placed in boreholes (kilodets) at a depth of 45 to 55 cm.
For example, to make a hole for a shelter for a cross-country carrier with a missile and a prime mover, it will be necessary to use 12 charges of 25 to 35 kg each and 2 charges of 10 to 15 kg each (the distances between the charges - 180 cm, the depth at which they are placed - 110 cm).
The camouflage of combat formations in mountainous conditions is carried out according to the methods described above. Taking into account the large amount of soil scattered during the construction of shelters by the explosives method, in mountainous conditions more extensive use of artificial scarring of the terrain for camouflage must be employed.
Special Features of Engineer Preparation Under Winter Conditions
In principle the nature of engineer preparation for missile units under winter conditions does not differ from engineer preparation under normal conditions.
In winter, engineer preparation requires greater expenditure of manpower and equipment than in normal conditions in connection with this, it is essential, for the protection of personnel and equipment, to make use, first of all, of natural cover. The construction of earthworks when there is a deep layer of frozen soil should be kept to the 50X1-HUM minimum necessary.



Special features of winter conditions mainly influence the construction of earthworks, construction and maintenance of roads and cross-country routes and also camouflage of certain types of equipment and combat formations.

Shelters and blindages for personnel are constructed during winter in the same way as under normal conditions.

with snow of an insignificant depth, shelters for equipment are excavated in the ground and the snow used as camouflage. When the depth of snow is significant (80 cm or more) it is possible to construct shelters in the snow with parapets made from packed snow, also shelters any partly in the snow and partly in the ground.

In certain cases individual dugout shelters can be constructed with a covering to assist camouflage and as a protection from drifting snow.

The pits for the shelters, blindages and cover for equipment can be made by the use of explosives to blow out the soil with subsequent working of the slopes and the bottom of the pit, and also for breaking up the top frezen layer of soil for subsequent excavation of the pit with earth-moving equipment or manually.

The breaking-up of frozen ground can be carried out with explosives or with pneumatic and entrenching tools.

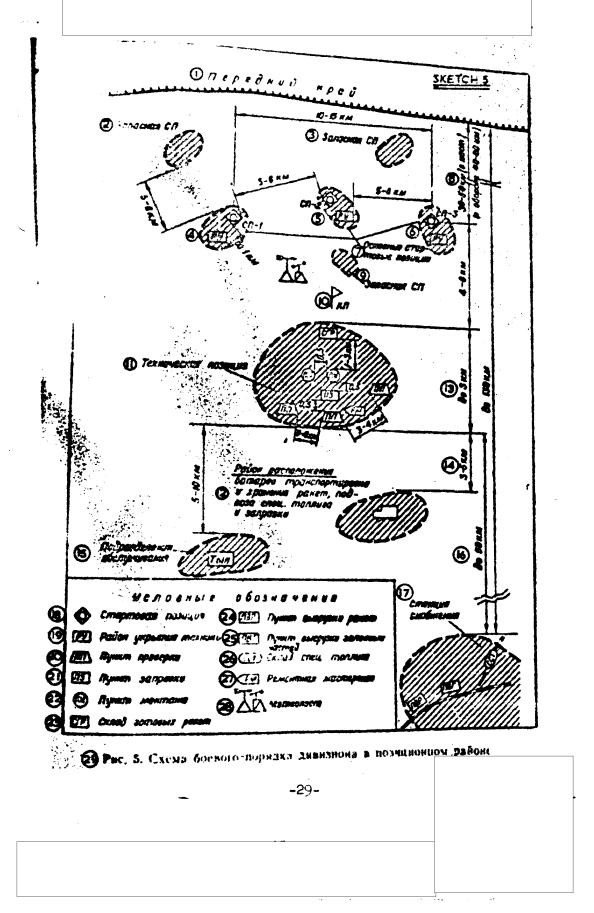
For mechanized work on frozen ground, hammer drills (burilnyy molotok) RP-17 or RPM-17 and pneumatic drills (otboynyy molotok) OMSP-5 are employed, run by a compressor.

Winter roads and cross-country routes are laid crosscountry, over frozen swamps, rivers, and lakes. The existing roads are widely utilized and are prepared for use in winter conditions.

During the construction (maintenance) of winter roads and cross-country routes, the main type of work will be the clearing of snow from the route. This clearing of the route is carried out with special snow-clearing machinery: tank snowplows STU, bulldozer BAT, tractor snowplows D-180B, as well as bulldozers and motor-graders.

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ment by t (sin (val	, the clear he simplest gle and dou	ing of snow means, whith ble - V blattel), and it	mercially may from the rich are consade) snowploice-chippersally.	coutes is ca structed in was, snow cl	rried out the units learers	
tank	red with sn	ow, for the	country rout e use of a a utilized (i	small number	of vehicles,	
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	SKETCH 5	

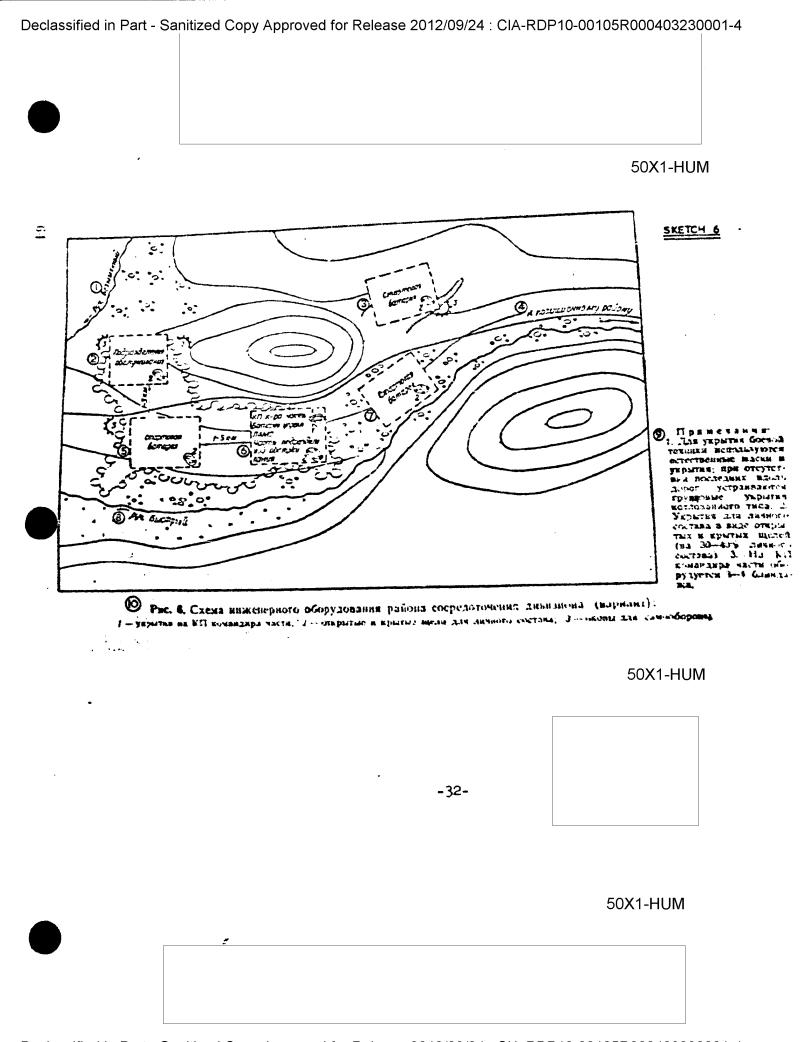
DIAGRAM OF A BATTALION IN COMBAT FORMATION AT THE SITING AREA

- Main line of resistance (1)
- Alternate launch site (2)
- Alternate launch site (3)
- Primary launch site 1 (up to 1 km) (4)
- Primary launch site 2 (5)
- Primary launch site 3 (6)
- Primary launch sites **(7)**
- 30-50 km (in an offensive) (in defense 40-80 km) (8)
- Alternate launch site (9)
- Command post (10)
- Technical position (11)
- Disposition area of the transport and storage of (12)missiles, delivery of special fuel, and fuelling batteries
- (13)up to 3 km up to 130 km
- 3-5 km (14)
- Servicing subunits Rear (15)
- up to 50 km (16)
- Supply railhead (17)

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Launch site (startovaya positsiya) (18)

(19)	Area of cover for equipment (rayon ukrytiya tekhniki)
(20)	Checkout point (punkt proverki) 50X1-HUM
(21)	Fuelling point (punkt zapravki)
(22)	Assembly point (punkt montazha)
(23)	Storage depot of ready missiles (sklad gotovykh raket)
(24)	Missile unloading point (punkt vygruzki raket)
(25)	Nose cone unloading point (punkt vygruzki golovnykh chastey)
(26)	Special fuel dump (sklad spets. topliva)
(27)	Repair workshop (remontnaya masterskaya)
(28)	Meteorological post (meteopost)
(28) (29)	Sketch 5. A diagram of a battalion in battle formation
•	and a battalion in battle formation
•	Sketch 5. A diagram of a battalion in battle formation
•	Sketch 5. A diagram of a battalion in battle formation at the siting area
•	Sketch 5. A diagram of a battalion in battle formation at the siting area
•	Sketch 5. A diagram of a battalion in battle formation at the siting area
•	Sketch 5. A diagram of a battalion in battle formation at the siting area
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•	Sketch 5. A diagram of a battalion in battle formation at the siting area
•	Sketch 5. A diagram of a battalion in battle formation at the siting area



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SKETCH 6

DIAGRAM OF THE ENGINEER PREPARATION OF THE CONCENTRATION AREA OF A BATTALION

- (1) Unnamed stream
- (2) Servicing subunits
- (3) Launch battery
- (4) To siting area
- (5) Launch battery
- (6) Command post of the commander of the unit. HQ battery. Mobile artillery meteorological station. Part of the servicing subunits
- (7) Launch battery
- (8) Fast-flowing stream
- (9) Notes: 1. For concealment of combat equipment natural camouflage and shelters are used: in their absence group shelters of dugout type are constructed along the roads.
 - Cover for personnel in the form of open and covered slit-trenches (for 30 to 40 percent of the personnel)
 - 3. At the Command Post of the commander of the unit, 3 or 4 blindages are provided.
- (10) Sketch 6. Sketch of Engineer Preparation of the concentration area of a battalion (Example):
 - Shelters at the command post of the commander of the unit;
 - 2. Open and covered slit-trenches for personnel;
 - 3. Trenches for self-defense.

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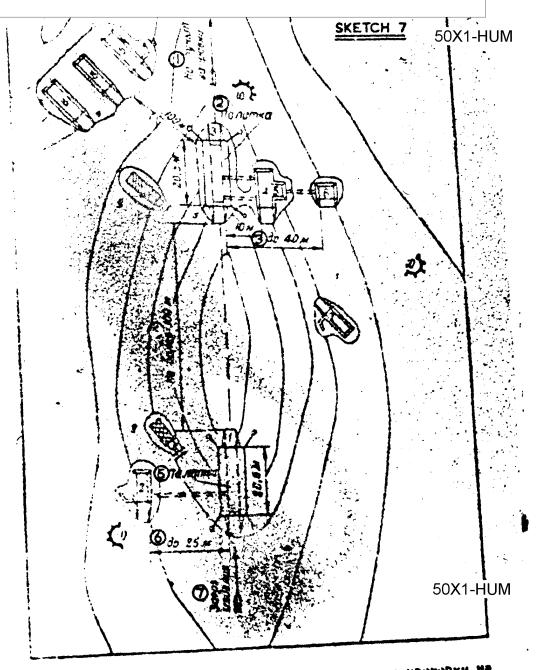
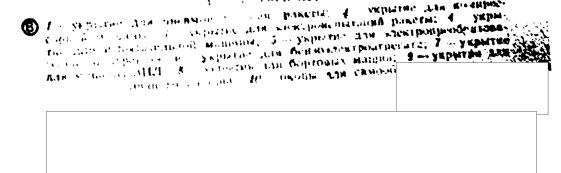
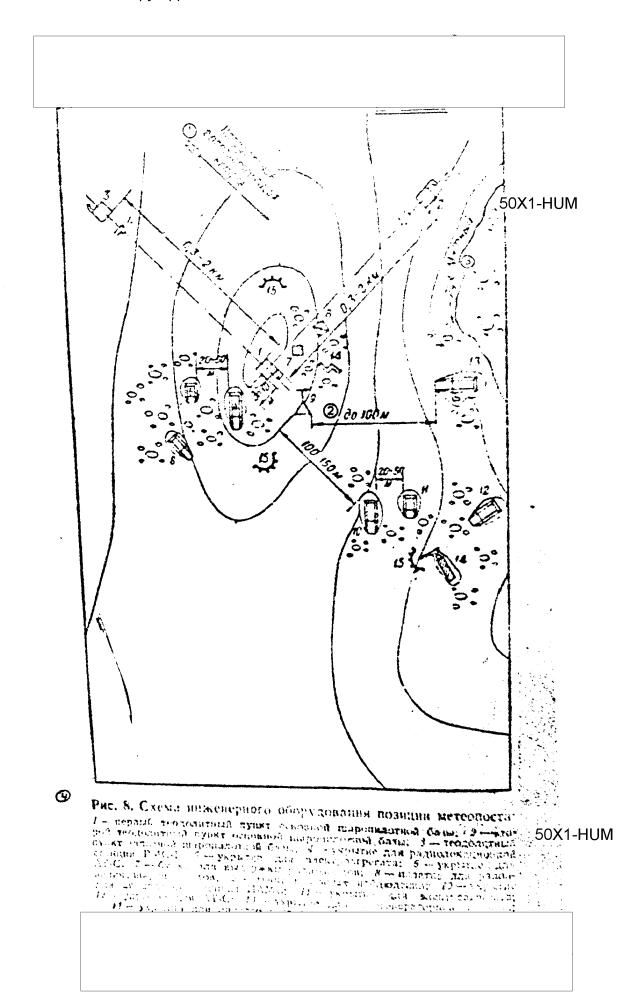


Рис. 7. Слема инготорого оборудования пункта проверки на



	SKETCH 7 50X1-HUM
	DIAGRAM OF ENGINEER PREPARATION OF A CHECKOUT POINT AT THE TECHNICAL POSITION
(1)	To fueling point
(2)	Tent
(3)	Up to 40 m
(4)	Not more than 100 m
(5)	Tent
(6)	
(7)	
(8)	Sketch 7. Diagram of engineer preparation of a checking point at the technical position.
	1. Shelter for pneumatic testing of the missile
	2. Shelter for compressors;
	3. Shelter for electrical testing of the missile;
	4. Shelter for testing equipment;
	 Shelter for the electro-converter assembly (elektropreobrazovatelnyy agregat);
	6. Shelter for the gasoline engine generator;
	7. Shelter for the ZIL vehicle;
	8. Shelter for open trucks (bortovaya mashina); 50X1-HUM
	9. Shelter for personnel;
	10. Trenches for self-defense.
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SKETCH 8

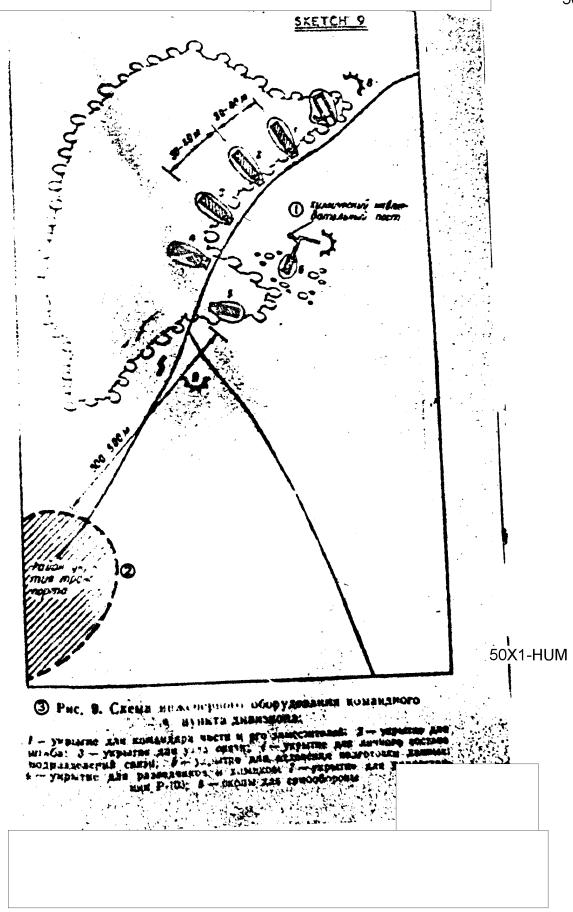
DIAGRAM OF ENGINEER PREPARATION OF A METEOROLOGICAL POST

- (1) Direction of prevailing winds
- (2) Up to 100 m
- (3) "Muddy" stream
- (4) Sketch 8. Diagram of engineer preparation of a meteorological post.
 - The first theodolite point of the main pilot balloon base;
 - The second theodolite point of the main pilot balloon base;
 - 3. Theodolite point of the alternate pilot balloon base;
 - 4. Shelter for radar station RMS-1;
 - 5. Shelter for the electrical assembly;
 - 6. Shelter for AT-S;
 - Shack for housing radiosondes;
 - 8. Tent for filling pilot balloons;
 - 9. Ground observation point;
 - 10. Shelter for the vehicle with apparatus of the field artillery meteorological station (PAMS);
 - 11. Shelter for the electrical assembly;
 - 12. Shelter for AT-S;
 - 13. Shelter for the gas-generating station;
 - 14. Shelter for personnel;

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15. Trenches for self-defense.



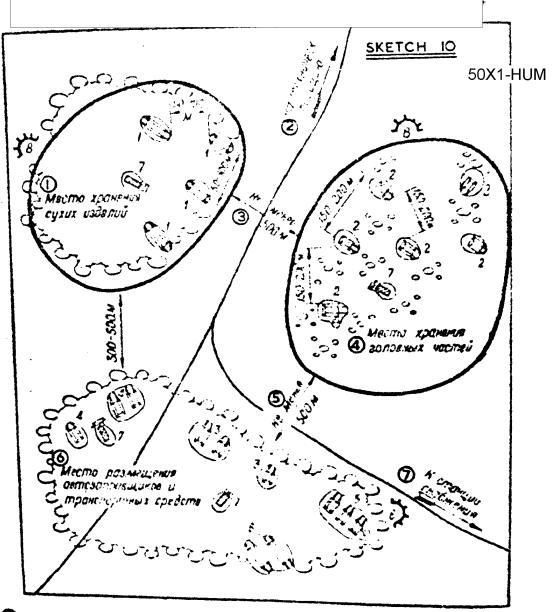


SKETCH 9

OF A BATTALION COMMAND POST

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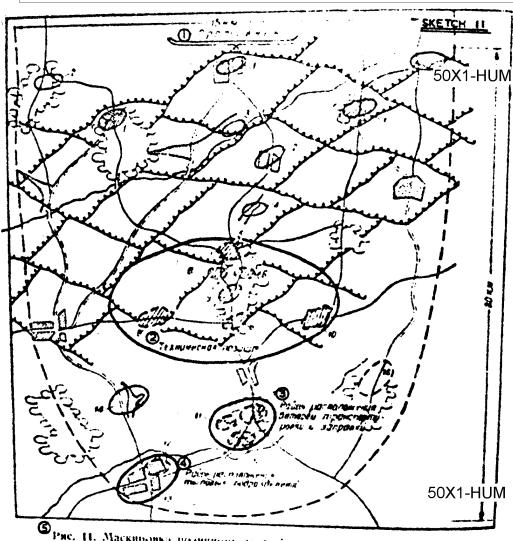
- (1) Chemical observation post
- (2) Shelter area for transport
- (3) Sketch 9. Diagram of the engineer preparation of a battalion command post.
 - Shelter for the unit commander and his deputies;
 - Shelter for the staff;
 - Shelter for the signal center;
 - 4. Shelter for the signals subunit personnel;
 - 5. Shelter for the data-computing section;
 - Shelter for reconnaissance and chemical personnel;
 - 7. Shelter for radio station R-103;
 - 8. Trenches for self-defense.



В Рис. 10. Слема наженерного собору сондани района распол 50X1-НИМ

Го-укрытия для контейноров с ровологи (до 10 игт); 2- укрытия для контейноров с головичен из 1 мен 1 с 20 игт); 2- укрытия для правинена сколосови (до 12 игт) с 30 игт); 2- укрытия для правинена сколосови (до 12 игт) с 4 карына для для обторьного (до 4 игт). Окрытия для обторьного (до 4 игт) с 4 игт) с 4 игт) с 3 иг

-40-



Pric. 11. Маскировка позиционного раздона диногнова (варилит):

— основное стартовая позиция: 2 - опастам стартовая раздения: 3 - позиция метеодтищий:

— NII дини мома. 6 - склад гитовых ракет искимиской вымании 6 - пумет монтажа позиция заправки; 8 - пумет монтажа мести у мести уровным сухих ракет. И мести храстерия, 13 - склад ГСМ: 14 райом месуственного распятичния местиости.

Примечание. Пунктиром показано движение груптовых тележек со стартовых полиций после их разгрузки.

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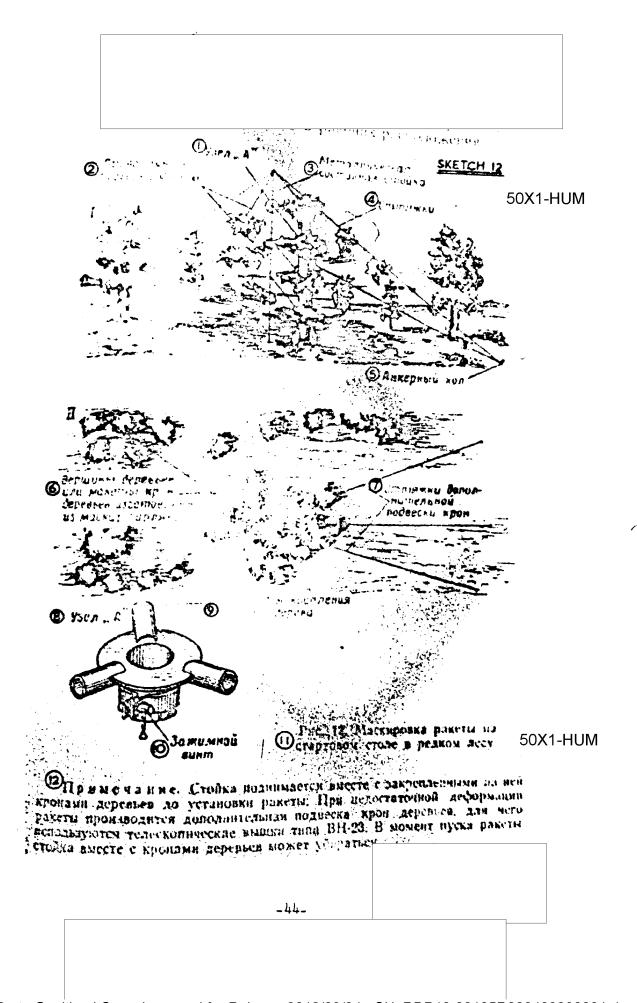
SKETCH 11

CAMOUFLAGE OF A BATTALION SITING AREA (VARIANT)

- (1) Enemy
- (2) Technical position
- (3) Disposition area of the transport and fueling battery
- (4) Disposition area of rear subunits
- (5) Sketch 11. Camouflage of a battalion siting area (variant):
 - 1. Primary launch site;
 - 2. Alternate launch site;
 - 3. Position of the meteorological station;
 - 4. Battalion command post;
 - Technical position storage depot for ready missiles;
 - 6. Missile assembly point (punkt montazha);
 - Fueling point;
 - 8. Checkout point;
 - 9. Storage place for dry missiles;
 - 10. Storage place for nose cones;
 - 11. Shelter area for transport means;
 - 12. Motor vehicle repair shop;
 - 13. POL dump;
 - 14. Area of artificial scarring of the ground.

Note: The dotted line shows the movement of the crosscountry carriers from the launch sites after unloading.

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		SKETCH 12
		50X1-HUM THE CAMOUFLAGING OF A MISSILE ON A
		LAUNCH PLATFORM IN A SPARSE FOREST
	(1)	Mounting (uzel) "A"
	(2)	Suspension cables of 3 mm diameter
	(3)	Metal sectional mast
	(4)	Guy lines
	(5)	Anchoring stake
	(6)	Tops of trees or mock-up of crowns of trees made from camouflage garlands.
	(7)	Guy cables for the additional suspension of crowns
	(8)	Mounting "A"
	(9)	Sleeve for bracing mockup tree crowns
	(10)	Clamping screw
	(11)	Sketch 12. The camouflaging of a missile on a launcher in a sparse forest
	(12)	Note: The mast is erected with the tree crowns already fixed in position before setting up the missile. If the missile is insufficiently disguised, an additional suspension of tree crowns is made using telescopic masts type VN-23. At the time of launching the missile, the mast with its tree crowns can be removed.
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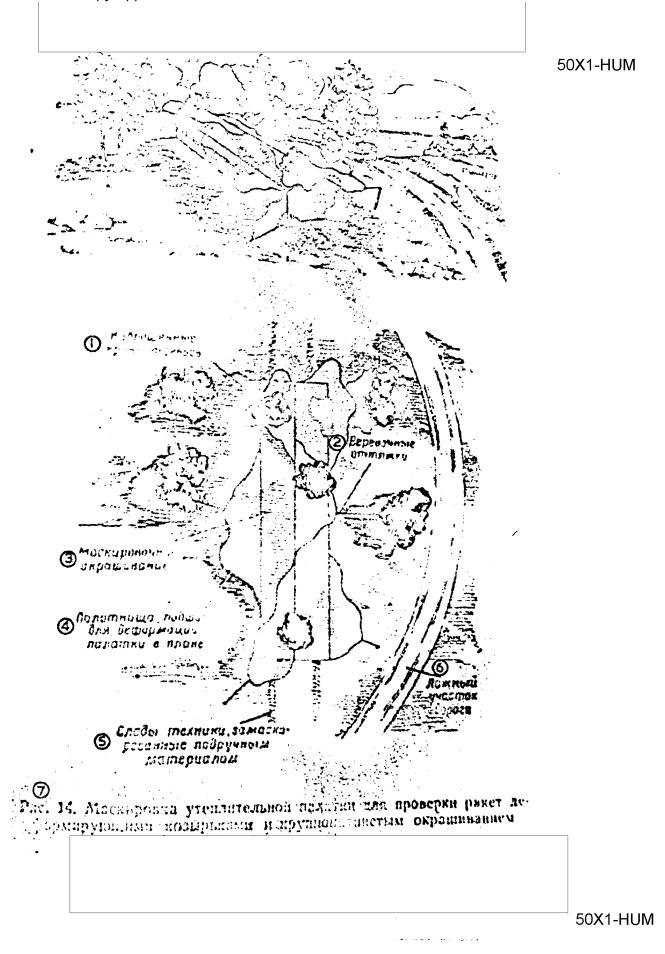
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HORIZONTAL CAMOUFLAGE NET FOR THE CONCEALMENT OF COMBAT EQUIPMENT AND TRANSPORT IN OPEN SECTORS OF THE TERRAIN

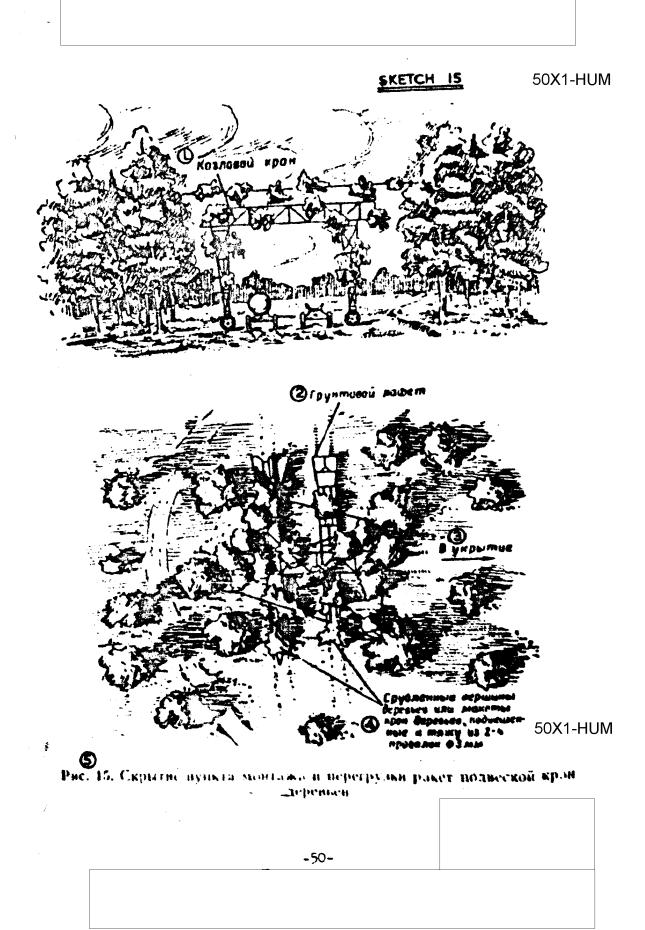
- (1) Dummy section of road
- (2) Caterpillar tracks camouflaged as the terrain background
- (3) Upper structure of the framework of the camouflage
- (4) Artificial ground scar
- (5) Camouflage covering of interlaced locally available materials
- (6) Cross-section between points numbered 1
- (7) Guy line
- (8) Mast
- (9) Sketch 13. Horizontal camouflage net for the concealment of combat equipment and transport in open sectors of the terrain

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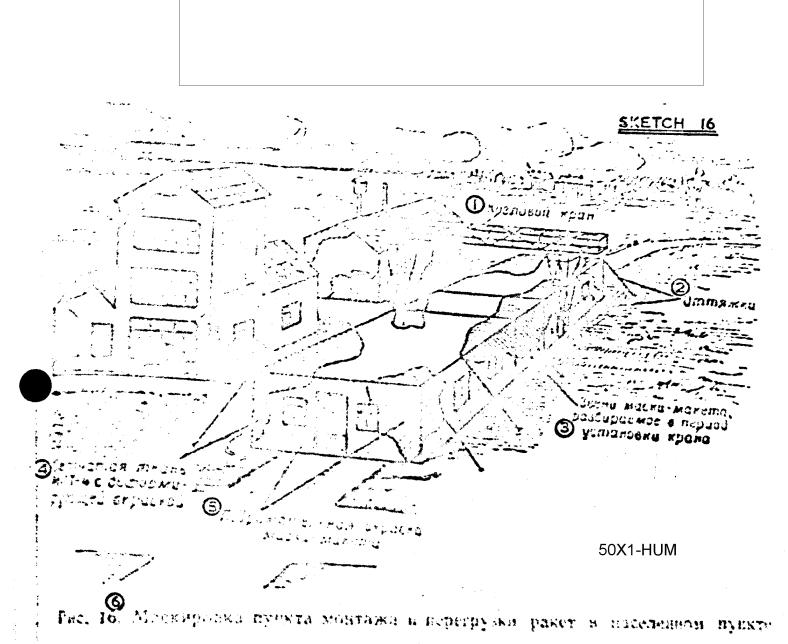
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	SKETCH 14	
<u>CA</u>	AMOUFLAGE OF A WARMING TENT FOR CHECKOUT OF THE MISS BY CHANGING THE OUTLINE WITH LIGHT OVERHEAD TRENCE COVERS AND LARGE PATCHES OF COLORING	50X1-HUM
(1)	Tree crowns put on top	
(2)	Guy ropes	
(3)	Camouflage coloring	
(4)	Panels sewed on to change the outline of the tent	
(5)	Tracks of the equipment camouflaged with locally a materials	available
(6)	Dummy section of road	
(7)	Sketch 14. Camouflage of a warming tent for checonomissiles by changing the outline with light overhead trench covers (kozyrek by painting large patches.	
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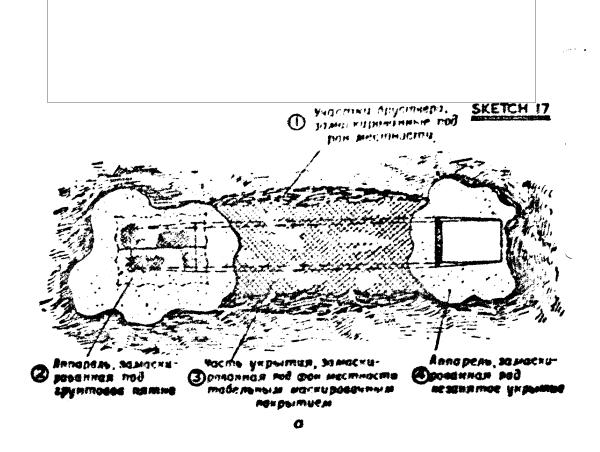


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		SKETCH 15				
CONCEA	LMENT OF A	MISSILE ASSEMB	TERE CHOWNS	LOADING		
	FOINT	BA BOSPENDING				
(1) G	antry crane	6				
(2) C	ross-count	ry carriage				
(O) T	- the shel	ter				•
•			kup tree cro	vas suspen	ded bead.	
(4) 8	TASG-OTY .	1 1 2 mm d	inneter stre	fCBen Ain-	24	
C	m 2 to 4 C	Poles or -	-			
	m 2 to 4 C	Fores or		ecophly as	d	ı
(5) 8	m 2 to 4 C	Poles or -		ecophly as	d	ı
	m 2 to 4 C	Concealment of transloading [ecophly as	d	,
	on 2 to 4 c	Concealment of transloading [ecophly as	d	,
	on 2 to 4 c	Concealment of transloading I crowns.		ecophly as	d	
	on 2 to 4 c	Concealment of transloading I crowns.		ecophly as	d	
	on 2 to 4 c	Concealment of transloading I crowns.		ecophly as	d	
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	on 2 to 4 c	Concealment of transloading I crowns.		ecophly as	d	
	on 2 to 4 c	Concealment of transloading I crowns.		ssembly and ending tre	d	
	on 2 to 4 c	Concealment of transloading I crowns.		ecophly as	d	
	on 2 to 4 c	Concealment of transloading I crowns.		ssembly and ending tre	d	



Примень нистранов Помас макимый та состают во металлических или дередерень стоих инспрамай и, продыдочных или вереновных гласей и сттожек. Тор-10 дые столы мыска макста выполновной резлацыными, по туру маршега.

		50X1-HUI
	SKETCH 16	
C	AMOUFLAGE OF A MISSILE ASSEMBLY AND TRANSLOADING	
<u></u>	POINT IN AN INHABITED LOCALITY	
(1)	Gantry crans	
(2)	Guy lines	
(3)	Unit of the camouflaged dummy that can be dismantled during the erecting of the crane.	
(4)	Netting MPT-4 with paint to break up the outline	
(5)	Simulated coloring of the camouflaged dummy	
(6)	Sketch 16. Camouflage of a missile assembly and trans- loading point in an inhabited locality	
	Note: The frame of the camouflaged dummy is made up of metal or wooden posts 4.5 meters high, cable or rope braces and guys. The outer walls of the camouflaged dummy are formed to open or be extended like a curtain.	
	••	
	}	
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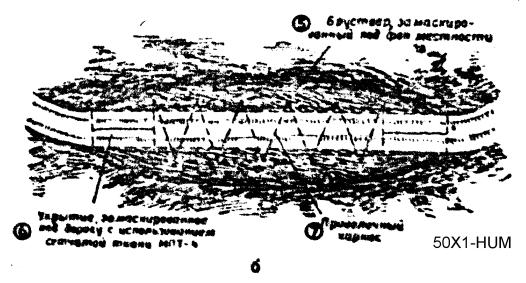


Рис. 17. Маскировка укрытий котливанного типа!
 – вод групповое пяти: и шезанатое укрытие: 6 - мая поста

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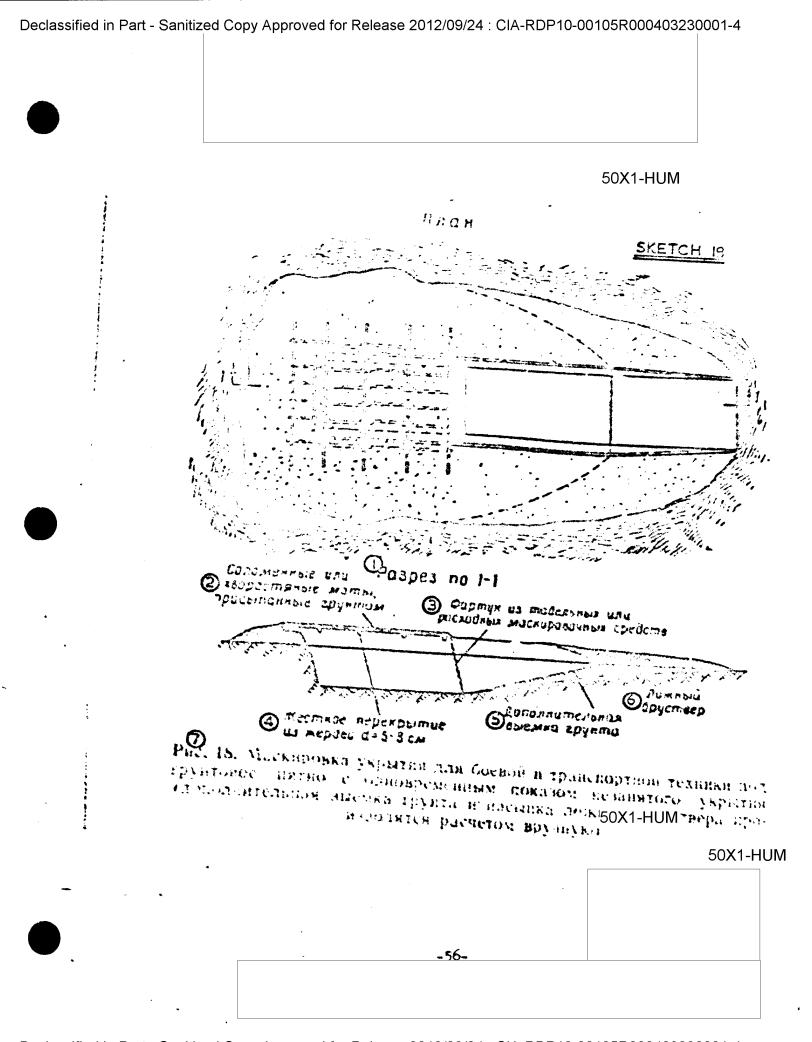
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SKETCH 17

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CAMOUFLAGE OF A DUGOUT TYPE OF SHELTER

- (1) Parts of the parapet camouflaged as the background of the terrain
- (2) Approach ramp camouflaged as a scar
- (3) Part of the shelter camouflaged as the background of the terrain using TOE camouflage covering
- (4) Approach ramp camouflaged as an unoccupied shelter
- (5) Parapet, camouflaged as the background of the terrain
- (6) Shelter, camouflaged as a road using MPT-4 netting
- (7) Wire frame
- (8) Sketch 17. Camouflage of a dugout type of shelter:
 - a As a ground scar and as unoccupied shelter;
 - b As a road.



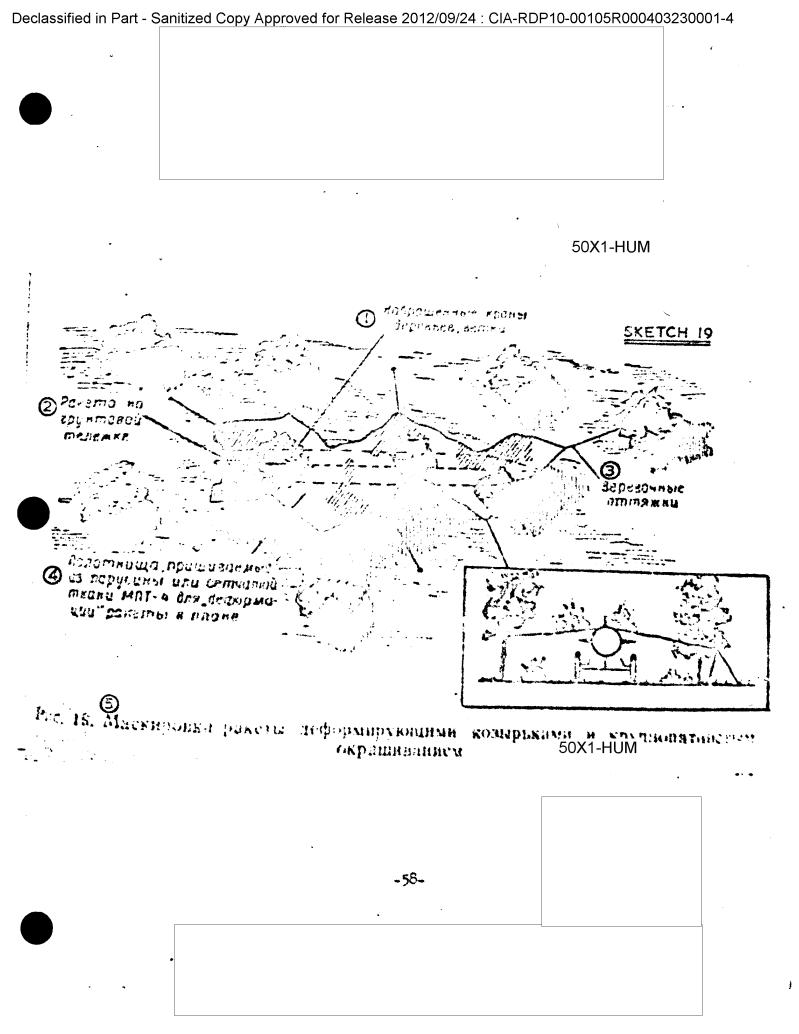
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SKETCH 18

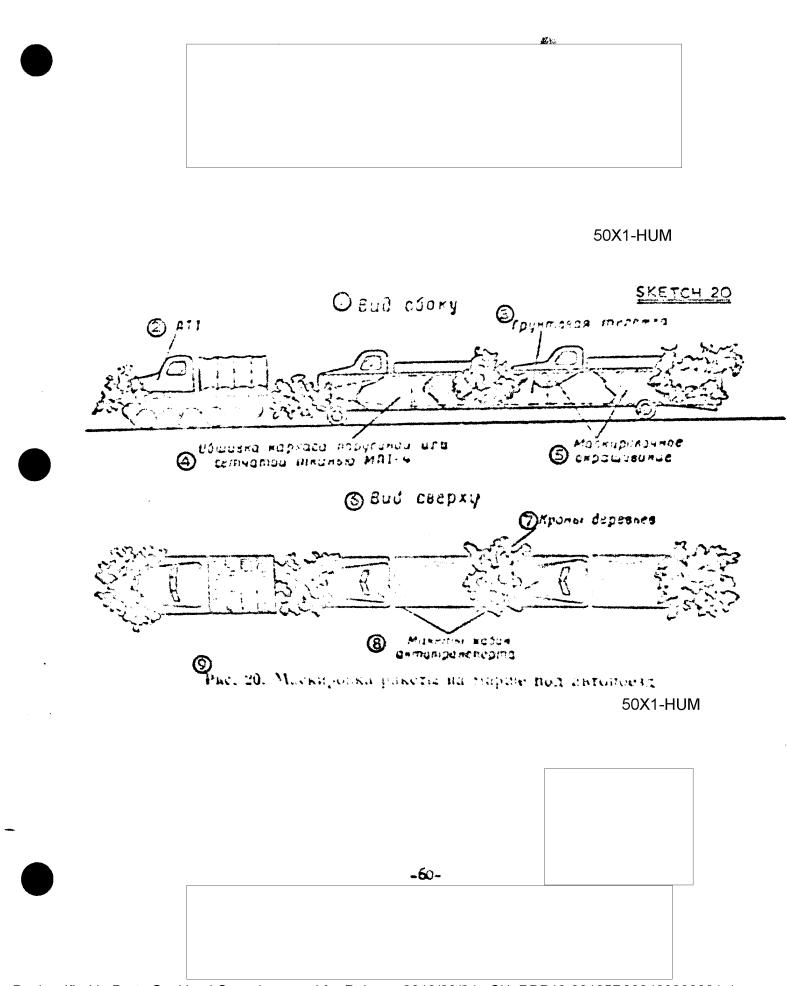
CAMOUFLAGED SHELTER FOR COMBAT AND TRANSPORT EQUIPMENT DISGUISED AS A GROUND SCAR, AT THE SAME TIME SHOWING AN UNOCCUPIED SHELTER

- (1) Cross-section between points numbered 1
- (2) Straw or brushwood mats sprinkled with soil
- (3) Apron made of TOE or expendable camouflage materials
- (4) Rigid overhead cover made with poles, 5-8 cms. in diamter
- (5) Additional excavation of the ground
- (6) Dummy parapet
- (7) Sketch 18. Camouflaged shelter for combat and transport equipment disguised as a ground scar, at the same time showing an unoccupied shelter.

 (Additional excavation of the ground and spreading of soil for the dummy parapet are carried out manually).



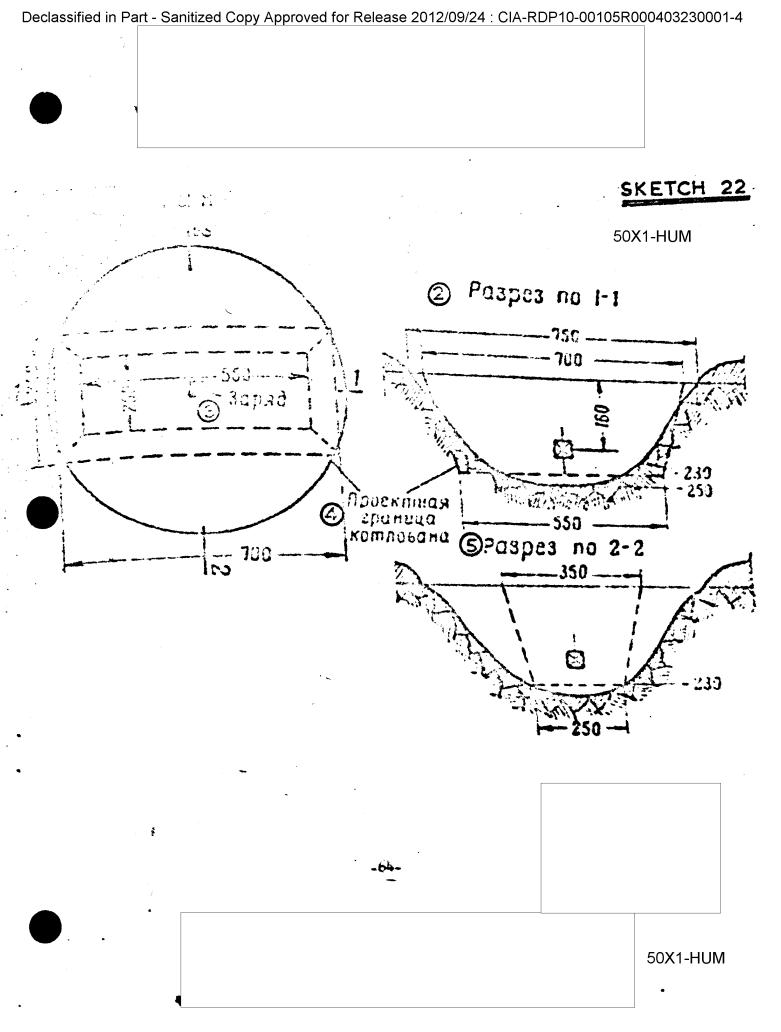
	SKETCH 19	
C	AMOUFLAGE OF MISSILE BY CHANGING THE OUTLINE WITH VERHEAD TRENCH COVERS AND BY PAINTING OF LARGE PATCH	ŒS.
LIGHT O	VERHIAN IRRIGAL COTAMO SINO ACCURATE	
(1)	Crowns of trees and branches put on top 50X1-H	-11 IN/I
	Missile on a cross-country carrier	IOIVI
	Guy ropes	
(4)	Panels made of canvas or MPT-4 netting to change the outline of the missile.	ne
(5)	Sketch 19. Camouflage of missile by changing the outline with light overhead treach coverand by painting large patches.	ers
		1
	50X1-HUM	



A MISSILE ON THE MOVE DISGUISED AS A VEHICLE CONVO (1) Side view (2) AT - T (3) Cross-country carrier (4) The frame covered with canvas or MPT-4 netting (5) Camouflage coloring (6) View from above (7) Tree crowns (8) Dummy vehicle cabs (9) Sketch 20. A missile on the move disguised as a vehicle convoy.		*		*
A MISSILE ON THE MOVE DISGUISED AS A VEHICLE CONVO (1) Side view (2) AT - T (3) Cross-country carrier (4) The frame covered with canvas or MPT-4 netting (5) Camouflage coloring (6) View from above (7) Tree crowns (8) Dummy vehicle cabs (9) Sketch 20. A missile on the move disguised as a vehicle convoy.				
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(3) Cross-country carrier (4) The frame covered with canvas or MPT-4 netting (5) Camouflage coloring (6) View from above (7) Tree crowns (8) Dunmy vehicle cabs (9) Sketch 20. A missile on the move disguised as a vehicle convoy.	(1)	Side view		
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(7) Tree crowns (8) Dummy vehicle cabs (9) Sketch 20. A missile on the move disguised as a vehicle convoy. 50X1-HUM	(5)	Camouf lage	coloring	
(8) Dummy vehicle cabs (9) Sketch 20. A missile on the move disguised as a vehicle convoy. 50X1-HUM	(6)	View from a	above	
(9) Sketch 20. A missile on the move disguised as a vehicle convoy. 50X1-HUM	(7)	Tree crowns	1	
vehicle convoy. 50X1-HUM	(8)	Dummy vehic	cle cabs	
50X1-HUM	(9)	Sketch 20.	A missile on the move d	isguised as a
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		*		SKET	CH 21
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		SKETCH 21		
Ĭ	MISSILE BEING TRA	NSPORTED DISGUISE	TO CAOL A RA C	LUMBER
			50	X1-HUM
(1)	Side view			
(2)	Cross-country car	rier		
(3)	The frame covered	with vanvas or h	IPT-4 netting	
(4)	View from above			
(5)	Shield of boards	15 x 2 cm To simulate the timber, the shie slabs		
(6)			ported disguise	d as a
	Trans	port of lumber.		
			5	60X1-HUM
		-63-		



THE CONSTRUCTION OF A PIT FOR A LIGHT TYPE DUGOUT SUBLITER WITH THE USE OF EXPLOSIVES

- (1) Plan
- (2) Cross-section between points numbered 1
- (3) Charge
- (4) Planned boundary of pit
- (5) Cross-section between points numbered 2

Table of Basic Data

	Categories of soil			
Designation of data	V	A1-A11	VIII-X	
Depth of excavation of hole in meters	1.7	1.7	1.7	
Expenditure of explosives for pit in kilograms	65	95	110	
Labor expenditure for work on pit, man-hours:				
Preparation for the explosion Manual finishing off work Total	1.5 27.5 29	5 44 49	7 60 67	

Categories of soil: V - stony ground, hard chalk;

VI-VII - friable rock (rashornaya skala); soft limestone; clay sandstone. badly cracked; 50X1-HUM

VIII-X - medium and hard limestones, granite, and others.

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